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7. improving sight distance around a horizontal curve;

8. enhancing highway aesthetics;

9. facilitating maintenance operations (e.g., snow storage);

10. providing additional lateral clearance to roadside appurtenances (e.g., guardrail, traffic signals);

11. facilitating pavement drainage;

12. providing space for pedestrian and bicycle use; and

13. providing space for bus stops.

45-1.02(03) Widths

Shoulder width will vary according to functional classification, traffic volumes, urban/rural location, curbed/uncurbed facility and the project scope of work. The tables in Chapters Fifty-three through Fifty-six present the paved and usable shoulder width criteria for these various conditions. See Section 49-5.0 for shoulder width where guardrail is required.

45-1.02(04) Surface Types

For new or reconstruction work on a State highway, all shoulders will be either paved with asphalt or concrete. Desirably, on 3R or partial 3R work on a State highway, the shoulders should be paved. However, sealed aggregate shoulders may be sometimes be appropriate. For a non-State highway, desirably, the shoulder should be paved. However, a sealed aggregate or earth surface is acceptable.

45-1.02(05) Cross Slopes

The cross slope of the shoulder varies according to the shoulder type and width. It should be the same across the full width of the usable shoulder.

Paved Shld. Width, (m)	Shoulder Cross Slope
≤ 1.2	2% [1]
> 1.2	2% [1] for the 0.6 m closest to the travel lane, then 4%

Notes:

[1] Where the travel lane tangent cross slope differs from 2%, the shoulder cross slope should match the travel lane cross slope.

2. The shoulder pavement section should be as described in Section 52-9.02(06).

PAVED-SHOULDER CROSS SLOPES, TANGENT SECTION, WITH UNDERDRAINS

Figure 45-1A(1)

Paved Shld. Width, (m)	Shoulder Cross Slope
≤ 1.2	2% [1]
> 1.2	4%

Notes:

[1] Where the travel lane tangent cross slope differs from 2%, the shoulder cross slope should match the travel lane cross slope.

2. The shoulder pavement section should be as described in Section 52-9.02(06).

PAVED-SHOULDER CROSS SLOPES, TANGENT SECTION, WITHOUT UNDERDRAINS

Figure 45-1A(2)

One exception is noted in Section 55-4.03(02) Item 4. The tables in Chapters Fifty-three through Fifty-six provide the cross slopes used for each classification. For a paved shoulder of 1.2 m or narrower, the shoulder cross slope should be the same as that of the adjacent travel lane. See Figure 45-1A(1), Paved-Shoulder Cross Slopes and Pavement Treatments, Tangent Section, With Underdrains; or Figure 45-1A(2), Paved-Shoulder Cross Slopes and Pavement Treatments, Tangent Section, Without Underdrains.

The following summarizes INDOT and local public agency practices.

1. Paved. Typical cross slopes for paved shoulders are 4%.

2. Curb Offsets. Curb offsets are paved and will have the same cross slope as the adjacent travel lane, which is typically 2%.

3. Aggregate. Typical cross slopes for aggregate shoulders are 4 to 6%.

4. Earth. Earth shoulders typically have a cross slope of 6 to 8%.

45-1.02(06) Shoulder Corrugations

Shoulder corrugations should be considered for shoulders only on a roadway designed as a rural facility.

The minimum paved width for an outside shoulder to be corrugated is 1.8 m. If guardrail, concrete barrier railing, or another type of roadside barrier is adjacent to an outside shoulder, such minimum paved width is 2.1 m. The minimum paved width for a median shoulder to be corrugated is 1.2 m.

Shoulder corrugations should be milled, without regard to the shoulder pavement material.

45-1.03 Auxiliary Lanes

Auxiliary lanes include left- and right-turn lanes, acceleration and deceleration lanes, and climbing lanes. Desirably, an auxiliary lane should be the same width as the adjacent travel lane, but not less than 3.6 m. The tables in Chapters Fifty-three through Fifty-five provide the specific width criteria

for an auxiliary lane. The tables also provide the criteria for shoulder width adjacent to an auxiliary lane.

The cross slope for the auxiliary lane should generally be 1% greater than the adjacent through lane.

Chapter Forty-six presents additional information for two-way left-turn lanes.

45-1.04 Parking Lanes (On-Street)

The designer must evaluate the demand for parking for an urban project. Desirably, these parking needs will be accommodated by providing off-street parking facilities. Chapter Fifty-one provides information on the design and layout of off-street parking facilities. When providing on-street parking along an urban street, the designer should evaluate the following:

Warrants. Adjacent land use may create the need to provide on-street parking along an urban street. Parking lanes provide convenient access for motorists to businesses and residences. However, on-street parking reduces capacity, impedes traffic flow and may

c. Parking is prohibited within 15 m of the nearest rail of a railroad/highway crossing.

d. Parking is prohibited within 4.5 m of a fire hydrant.

e. Parking is prohibited within 9 m on the approach leg to any intersection with a flashing beacon, stop sign, or traffic control signal. For no-controlled or yield-controlled intersection, parking is not allowed within the intersection itself.

f. Parking is prohibited within 6 m on the near side of a fire station driveway entrance and 23 m from the entrance for the opposite side of the street.

g. Parking is prohibited on bridges or within a highway tunnel.

h. Parking is prohibited along the same side or opposite a street excavation or obstruction if it would obstruct traffic.

i. Parking should be prohibited from areas designated by local traffic and enforcement regulations (e.g., near school zones, loading zones, bus stops). See local ordinances for additional information on parking restrictions.

45-1.05 Curbs

Curbs are often used on an urban facility to retain the cut slope, control drainage, delineate the pavement edge, reduce right-of-way requirements, channelize vehicular movements, and improve aesthetics. In an urban area, curbs have a major benefit in containing the drainage within the pavement area and in channelizing traffic into and out of adjacent properties.

A curbed cross section is an appropriate design option in an outlying suburban or intermediate setting, or in an area undergoing or in imminent transition from rural-to-suburban land use, as well as in a low-speed or built-up urban setting. This clarification and latitude to expand opportunities for selection of a curbed cross-section is due in part to a desire by INDOT to plan each facility in context with existing and planned land-use characteristics.

45-1.05(01) Warrants For a Curbed Section

Selecting a curbed section or uncurbed section depends upon many variables, including vehicular speeds, urban/rural location, drainage and construction costs. The following discusses those factors which will determine whether or not a curbed section is warranted.

1. Urban Location. A curbed section is typically used in a Built-Up urban area due to restricted right of way, other constraints, and to better delineate travel lanes or parking lanes from pedestrian use areas.

   A curbed section may be considered in a Suburban or Intermediate location for a design speed as high as 90 km/h. The use of a curbed or uncurbed section will be made on a project-by-project basis, considering right-of-way constraints, drainage, pedestrian activity, channelization needs, driveway access control, etc. This applies to new construction, 4R, or 3R work in each design classification other than freeway. The exceptions listed under Item 2 below for a rural location also apply to a high-speed Suburban facility.

2. Rural Location. The use of curbs on a rural highway is usually limited to conditions such as the following:

   a. where there is sufficient development along the highway and there is a need to channelize traffic into and out of properties;

   b. where it is absolutely necessary to control drainage;

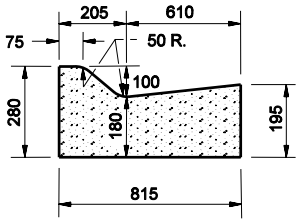
   c. where restricted right-of-way provides insufficient space for roadside ditches;

   d. to lessen property impacts;

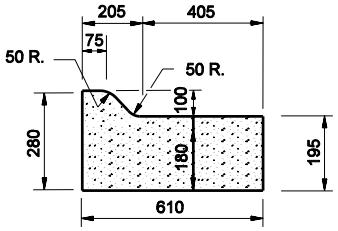
   e. to prevent soil erosion;

   f. the design speed is 90 km/h or lower; or

   g. where otherwise deemed absolutely necessary.



COMBINED CONCRETE CURB AND GUTTER, TYPE B (SLOPING)



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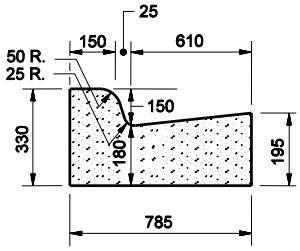

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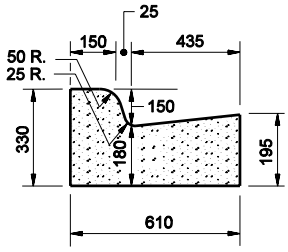

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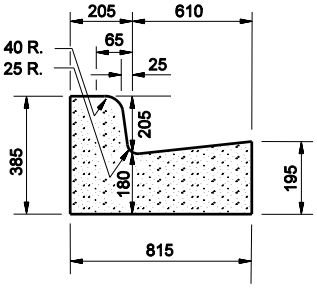
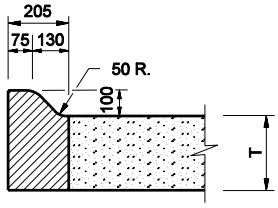
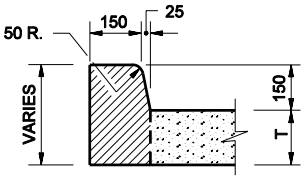


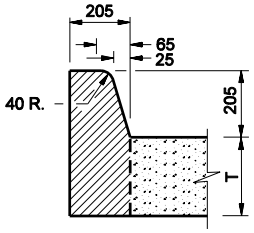
COMBINED CONCRETE CURB AND GUTTER, TYPE C (VERTICAL)



INTEGRAL CONCRETE CURB TYPE B (SLOPING)



INTEGRAL CONCRETE CURB (VERTICAL)



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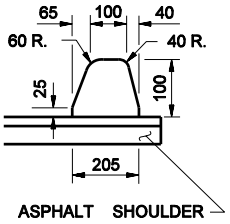
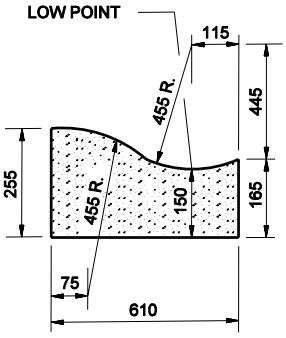
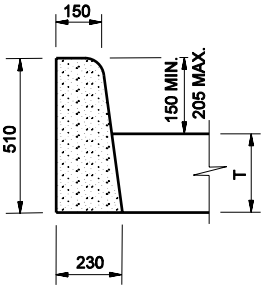


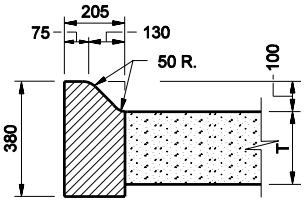
ASPHALT CURB (SLOPING)



ROLLED CURB (SLOPING)



CONCRETE CURB (VERTICAL)



CONCRETE CURB TYPE B (SLOPING)

Figure 45-1D

NOTE: ALL DIMENSIONS ARE IN mm.

CURBING TYPES

Figure 45-1D

Shoulders may be appropriate in a curbed cross section. However, it is acceptable practice not to provide a shoulder aside a curb for a design speed of 90 km/h or lower. The appropriate tables in Chapters Fifty-three, Fifty-four, and Fifty-five show the shoulder width adjacent to a curb where a shoulder is used.

45-1.05(02) Types

There are generally two types of curbs, sloping and vertical. A sloping curb typically has a height of 100 mm or lower with a face batter no steeper than approximately one horizontal to one vertical. A vertical curb typically has a height of up to 150 mm with a face batter steeper than one horizontal to six vertical. The INDOT *Standard Drawings* illustrate the typical curb sections used by the Department, and provide details for these and other curb types.

1. Sloping Curb.

   a. Curb Height of 100 mm. This curb height should be used where a curb is determined to be warranted and the design speed is 50 km/h or higher. In a Suburban or Intermediate urban location, the curb should be located at the edge of the paved shoulder. The shoulder widths to be used in either of these locations are shown in Tables 53-6 through 53-9, and Tables 55-3E through 55-3H.

   b. Curb Height of 85 mm. This curb height should only be used by a local public agency in a residential area where curbs are determined to be warranted. It should not be used on an INDOT-maintained route. However, it may be used to reconstruct a local street disturbed by INDOT-facility construction.

2. Vertical Curb. A vertical curb is generally only used on a low-speed, urban Built-Up facility where the design speed is 40 km/h or lower. A vertical curb may be used where the design speed reaches 60 km/h, but only for drainage or curbed-section continuity.

Although a vertical curb may deflect a vehicle at a lower speed, it should not be used in lieu of guardrail as protection from obstructions. Where vehicular encroachment is permissible, a sloping curb should be used.

45-1.05(03) Curb Type Selection

1. Materials. Concrete curbs are typically used. However, for a project on an existing facility, asphalt curbing, not to exceed 100 mm in height, may be used under guardrail to control erosion. Asphalt curbing may also be used for a temporary island or a temporary median within a construction zone, etc. Where snow plowing operations are conducted, asphalt curbing may be subject to severe damage or total removal. Therefore, it should not be used where damage from snow plows can be expected.

2. Speed. Vertical curbs are generally only used on a low-speed, urban facility where the design speed is 70 km/h or lower. Preferably, curbs should not be used along a rural or high-speed urban highway (i.e., that with a design speed of 80 km/h or higher). If curbs are deemed necessary, only sloping curbs located at the edge of the shoulder should be used on such a high-speed facility.

3. Vehicular Encroachment. Although at a lower speed a vertical curb may deflect a vehicle, it should not be used in lieu of guardrail as protection from a hazardous object. Where vehicular encroachment is permissible, a sloping curb should be used.

4. Sidewalks. Where sidewalks are present or to be constructed in an urban area, curbs may be used. Consideration should be given to the types of curbs existing or proposed in similar conditions within the adjacent geographical area.

5. Island. Where a divisional or directional island is used, a raised corrugated island should be used. Section 46-9.0 and the INDOT *Standard Drawings* provide additional information on the design and placement of raised corrugated islands.

6. Local Practices. The designer should strive to meet the prevailing local practice for a State highway where such practice does not conflict with Department criteria. Where local practices differ, INDOT criteria should prevail. On a non-State facility, local practices will normally govern.